



Long-Term Pavement Performance

LTPP North Central Regional Office

505 West University Avenue - Champaign, IL 61820-3915 - Tel 800 344-7477 - Fax 217 356-3088 - www.ncrco.com

May 30, 2001

Mr. Jack Springer, HRDI-13
FHWA-LTPP
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296

Re: SPS Construction Report for SPS-5 south of Branson, Missouri

Dear Mr. Springer,

I have enclosed a copy of the SPS construction report for the SPS-5 near Branson, Missouri. Reports for the remaining projects in Missouri will be completed in the near future, and sent to you as they are available. Please let me know if you have any comments or questions concerning this report. You may contact me at 217/356-4500.

Sincerely,

Brenda B. Mehnert
ERES Division of ARA, Inc.

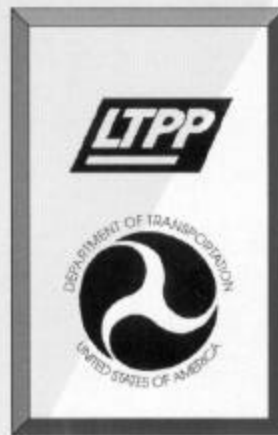
Enclosures:

cc: M. Symons (FHWA-COTR)
J. Jiang (LTPP-DATS)

Construction Report for Missouri SPS-5

DTFH61-96-C-00013

May 30, 2001



Submitted by



A Division of Applied Research Associates, Inc.

**SPS-5 Construction Report
Taney County, Missouri
US-65 NB
South of Branson, Missouri**

Sections 290501 through 290509

**Federal Highway Administration
LTPP Division
North Central Region**

**Report Prepared By:
Brenda B. Mehnert**

**ERES Consultants
A Division of Applied Research Associates, Inc.
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Champaign, Illinois 61820**

May 30, 2001

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ATTACHMENT A: PROJECT LOCATION

ATTACHMENT B: SITE LAYOUT

ATTACHMENT C: MATERIAL SAMPLING AND TESTING PLAN

ATTACHMENT D: LAYER DESCRIPTION AND THICKNESS FOR EACH SECTION

ATTACHMENT E: PROJECT DEVIATION REPORT

1 Project Overview

The Strategic Highway Research Program (SHRP) SPS-5 project investigates rehabilitation of asphalt concrete pavements. Some of the primary factors considered in the selection of an appropriate overlay design and addressed on the long-term pavement performance of these pavements are:

- Pavement condition
- Environment
- Traffic
- Pavement preparation (minimum vs. extensive)
- Virgin or recycled asphalt concrete

The in-service tests performed in this study will quantify the influence of these parameters on pavement performance (life expectancy), and ultimately improve current design procedures. The analysis of information developed will help highway agencies select more economical methods and strategies for the rehabilitation of existing asphalt concrete pavements.

Eight test sections and one control section were rehabilitated with asphalt concrete overlays. Different pavement preparations, as well as varying asphalt concrete thickness and type of asphalt concrete were used. All the sections were constructed with the same type of base layer and subgrade—crushed stone over a coarse-grained subgrade.

This report summarizes the “as-built” pavement layers of the Missouri 290500 site reconstructed in August 1998. Field tests were performed, and laboratory samples obtained and analyzed, at different stages of construction from each test section. All samples were taken from the northbound lane.

1.1 Experiment Cell

The Missouri 290500 site is located in the wet-freeze environmental zone and was constructed on a coarse-grained subgrade. The primary reason for rehabilitation was the poor condition of the existing pavement—fatigue cracking pavement distress. Patching of the existing pavement was part of the surface preparation prior to overlay.

The existing pavement was originally opened to traffic in 1982 and consisted of the following structural layers:

Table 1. Existing Missouri 290500 structural layers.

Layer	Material
Subgrade	Coarse-grained material clayey gravel
Base	102 mm crushed stone
AC binder	173 to 198 mm of Missouri DOT mix
AC surface	25 to 33 mm of Missouri DOT mix

1.2 Project Location

The Missouri 290500 project is located on the northbound lane, on US Highway 65 (US-65) in Taney County, Missouri. This project is 8.7 km from the Missouri/Arkansas State Line near Branson, Missouri. Specifically, the nine sections are located on the northbound lane of this two-lane undivided road. Attachment A is a general project location map.

Two sections are located entirely on fill sections, and seven are located in cut sections. The shortest transition between consecutive test sections is 244 m. Located 394 km on the same route is the nearest GPS section 297073. The lanes are 3.7 m wide and have asphalt concrete (AC) shoulders that are 3 m wide. There are no subsurface edge drains used at this site.

1.3 Project Layout

The Taney County 290500 site incorporates nine SHRP sections. Attachment B contains the test section layout that summarizes nominal surface thickness and layer descriptions.

1.4 Traffic Characteristics

This two-lane road is classified as a rural principal arterial road. The nomination form submitted by the Missouri Department of Transportation indicated the traffic data at the time of construction shown in Table 2.

Table 2. Traffic data for Missouri 290500.

Annual Average Daily Traffic (two directions)	9350
% Heavy Trucks and Combinations (of AADT)	12%
Count year of AADT Estimate	1996
Traffic Growth Rate Since Project Opened to Traffic (%/yr)	3.9%
18K ESAL Rate in Study Lane (1000 ESAL/YR)	170
Year of ESAL Rate Estimate	1996

ESAL = Equivalent single axle load.
AADT = Annual average daily traffic

1.5 Limits of Test Sections

Table 3 shows the limits of the test sections at the SPS-05 site. Each test section includes a monitoring section of 152 m (500 ft) and 15 m (50 ft) at each end of the monitoring section to be used as sampling areas.

Table 3. Limits of Missouri 290500 sections.

Test Section #	Test Section		500-ft Monitoring Section	
	Beginning Station	End Station	Beginning Section	End Station
290501	1038+00	1044+00	1038+50	1043+50
290502	1054+50	1060+50	1055+00	1060+00
290503	1071+50	1077+50	1072+00	1077+00
290508	1095+50	1101+50	1096+00	1101+00
290509	1134+50	1140+50	1135+00	1140+00
290507	1155+50	1161+50	1156+00	1161+00
290506	1182+50	1188+50	1183+00	1188+00
290504	1197+50	1203+50	1198+00	1203+00
290505	1224+00	1230+00	1224+50	1229+50

1.6 Weather Monitoring

There was no automatic weather station (AWS) unit installed specifically for this site. The closest AWS unit, installed in February 2000, is located inside the Missouri DOT maintenance yard in Ozark, Missouri.

1.7 Traffic Monitoring

There was no traffic-monitoring device installed near this site.

1.8 Personnel

North Central Regional Coordination Office

ERES Consultants
 Tom Wilson
 Principal Investigator
 505 West University Avenue
 Champaign, Illinois 61820 (800) 344-7477

Material Testing

Braun Intertec Corporation
 Bruce M. Thorson, PE or David Clauson
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 P.O. Box 39108
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LTPP Design Review

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Construction Contractor

Leo Journagan
Journagan Construction Co., Inc.
3003 E. Chestnut Expressway
Suite 1200
Springfield, MO 65802 (417) 839-2173

1.9 Known Deviations from Guidelines

Attachment E contains project deviation reports filled out during and after construction.

1.10 Summary of Key Construction Equipment

Surface Preparation Equipment

- CMI Milling Machine Model 419-102

Asphalt Concrete Pavement Placement

- Grayhound (CR461) paver
- 10.7-ton steel-wheel tandem roller
- 11.1-ton pneumatic-tired roller
- 11.0-ton double-drum vibrator roller
- Asphalt concrete source = Koch #2370 Muskogee, OK
- Asphalt concrete drum mix

2 Project Details

Project meetings were held before construction began. Representatives from the contractor, sub-contractors, LTPP, and Missouri DOT attended these meetings. Sampling of the existing pavement was performed in February 1998. Overlay operations began in late August 1998 and were completed by mid-September 1998. The new overlay was then sampled in December 1998.

2.1 Design Features

Table 4 summarizes the surface preparation and overlay asphalt concrete type used for each section.

Table 4. Summary of surface preparation and overlay material for each section.

Test Section Number	Surface Preparation	Mill Depth (mm)	Overlay Thickness (mm)	Type of AC Overlay Mix
290501*	none	-	-	-
290502	Minimum Pavement Repair	-	53	Recycled
290503	Minimum Pavement Repair	-	122	Recycled
290508	Cold Mill & Asphaltic Tack Coat	51	193	Recycled
290509	Cold Mill & Asphaltic Tack Coat	48	104	Recycled
290507	Cold Mill & Asphaltic Tack Coat	28	163	Virgin
290506	Cold Mill & Asphaltic Tack Coat	51	104	Virgin
290504	Minimum Pavement Repair	-	127	Virgin
290505	Minimum Pavement Repair	-	56	Virgin

* Control section

2.2 Material Sampling and Testing

Material sampling before construction was completed in February 1998. Post-construction sampling was not performed until December 1998. Locations of material sampling and field testing for each layer are given in attachment C. LTPP sampling field testing procedures have been developed specifically for the SHRP SPS-5 program, and all activities were performed in accordance with these guidelines unless noted in attachment E. Samples for laboratory testing were sent to Braun Intertec and the Missouri Department of Transportation in Jefferson City, Missouri.

2.3 Construction Activities

Section 290501, the control section, did not receive any overlay treatment. Cold milling in sections 290506, 290507, 290508, 290509 was completed before the AC overlay. This operation

was completed using a CMI 419-102 milling machine. Milling operations were started and completed by mid-August 1998. No patching was done after milling.

All outside shoulders were restored using the same asphalt concrete material as the adjacent section. There was no joint sealant used between the lane and shoulder.

2.4 Asphalt Paving

Paving operations began August 27, 1998, and were completed September 18, 1998. Two asphalt concrete mixes are used, recycled and virgin surface course. The Journagan Drum Mix Plant, located 6 minutes from the site, produced the hot mix asphalt concrete for this site. The hot mix recycled asphalt pavement was crushed and screened and the aggregates were reclaimed. Placement of the asphalt concrete was performed with a Grayhound, model CR461 paver with a laydown width of 3.7 m. There was one longitudinal surface joint located within the lane. The mean laydown temperature of the asphalt was 149°C, and the air temperature was 32.2°C.

The tack coat material was type SS-1 and was used as the minimum surface preparation before the overlay material was placed. There was no tack coat material used between lifts. Typically, for the AC surface layers, breakdown compaction was performed with an 11-ton double-drum vibrator roller. The intermediate compaction consisted of an 11.1-ton pneumatic tired roller and the final compaction was obtained with a 10.7 steel-wheeled tandem roller.

Attachment A
Project Location

Missouri (29)

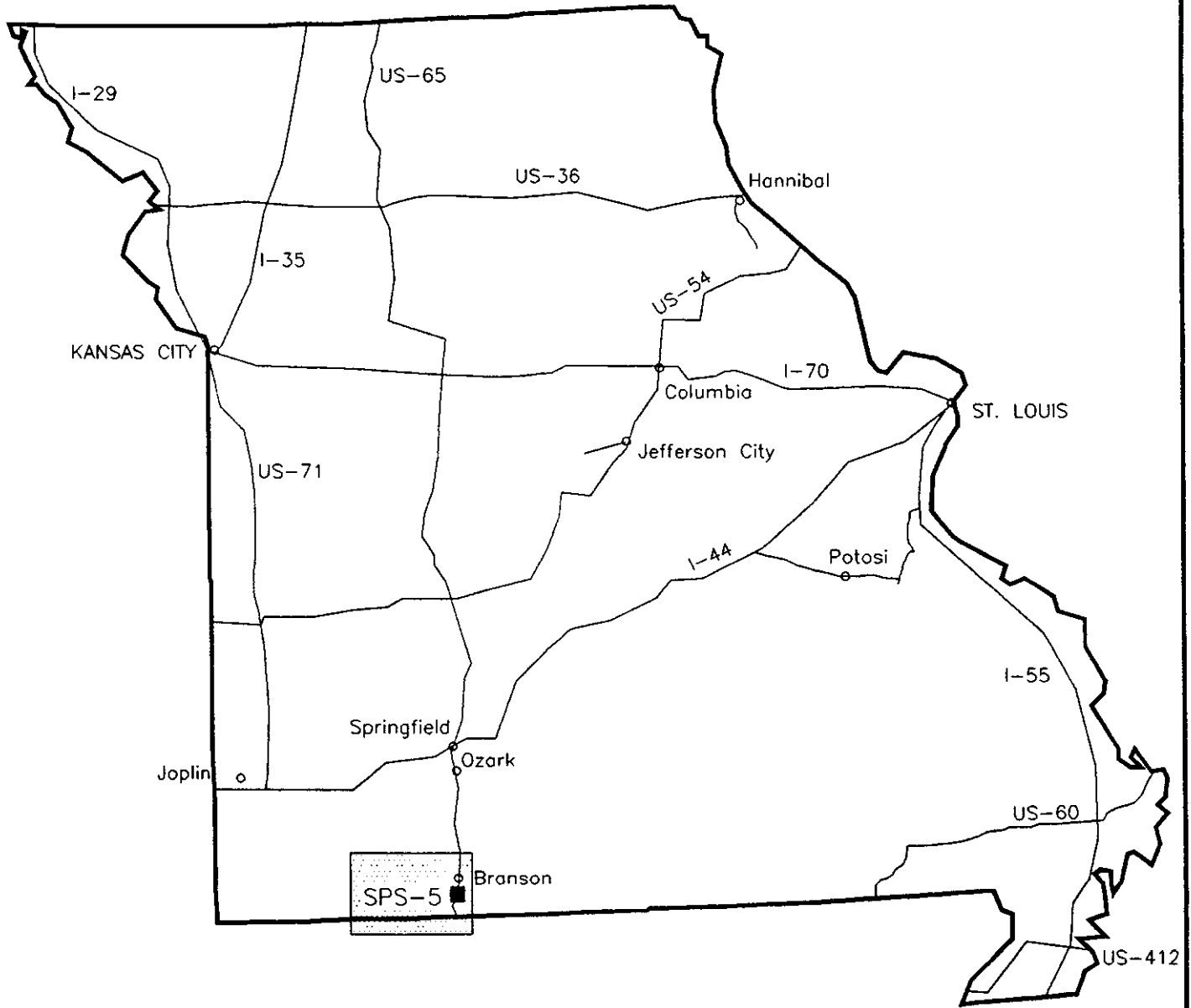


Figure A-1. General Project Location.

Attachment B

Site Layout

MISSOURI SPS-5

US-65 NB
South of Branson

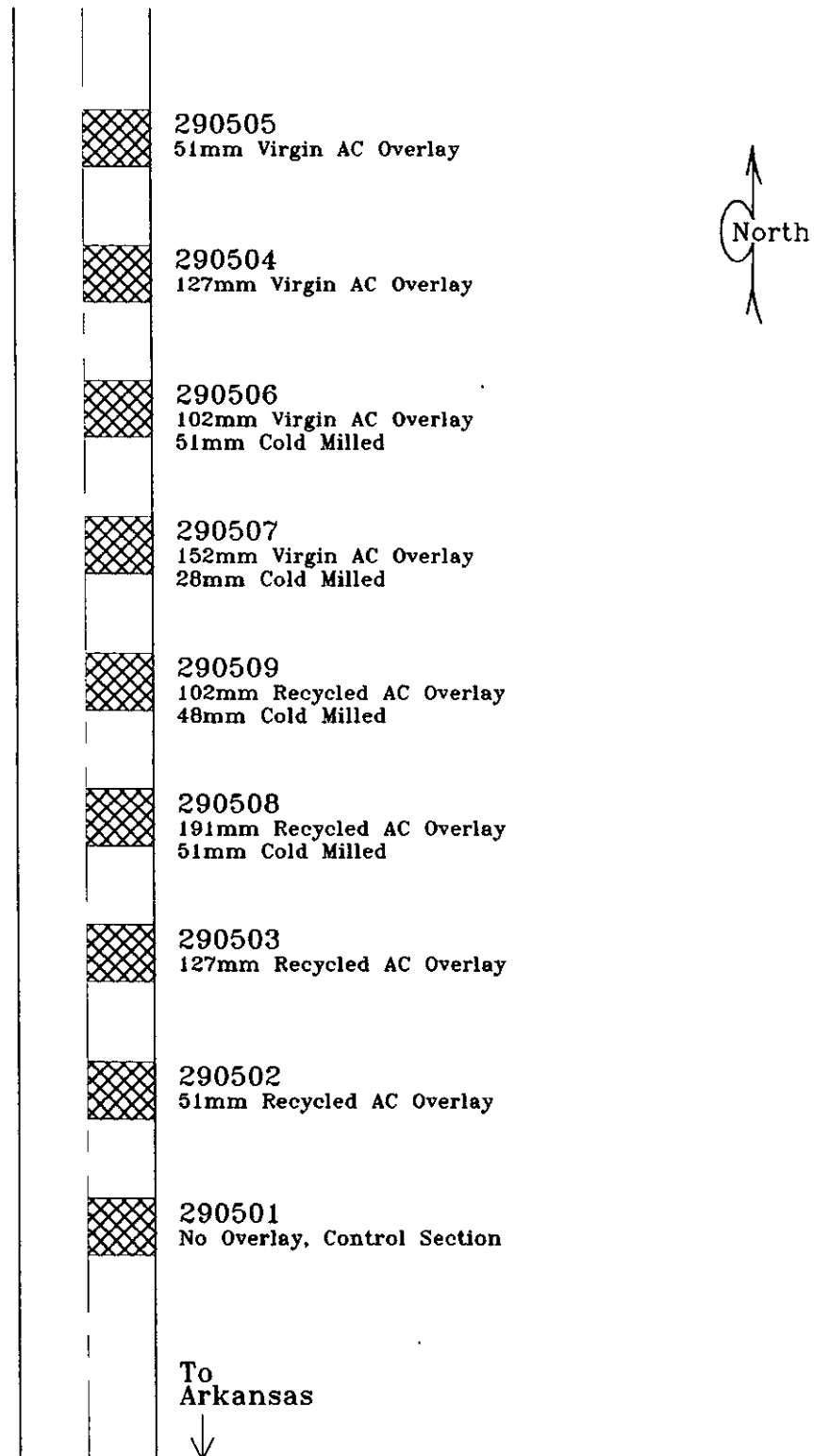


Figure B-1. Missouri 290500 Site Layout.

Revised 03-12-00

Attachment C

Material Sampling and Testing Plan

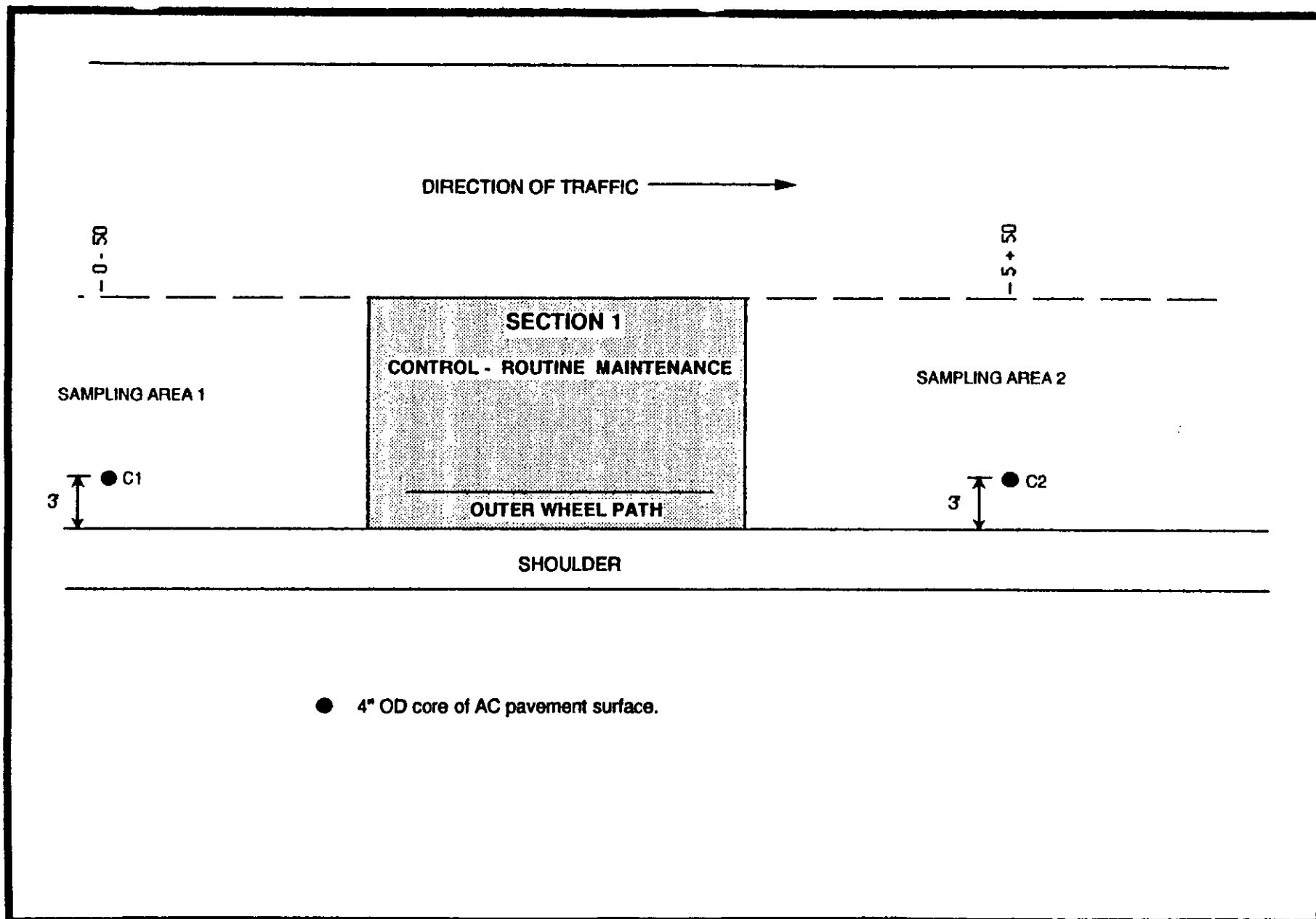


Figure A.2. Example of "Pre-Construction" Sampling Plan for Section 1.

DIRECTION OF TRAFFIC →

20+0
18+0
16+0
14+0
12+0

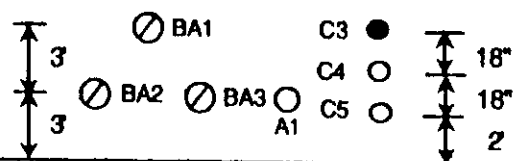
50+5

SAMPLING AREA 3

SECTION 2

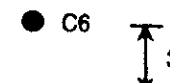
MINIMUM SURFACE PREPARATION
2" RECYCLED AC

SAMPLING AREA 4



OUTER WHEEL PATH

SHOULDER



- 4" OD core of AC pavement surface.
- 4" OD core of AC pavement surface and treated layers.
- 6" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Representative to 4' below top of subgrade.
- ⊗ 12" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval.

Figure A.3. Example of "Pre-Construction" Sampling Plan for Section 2.

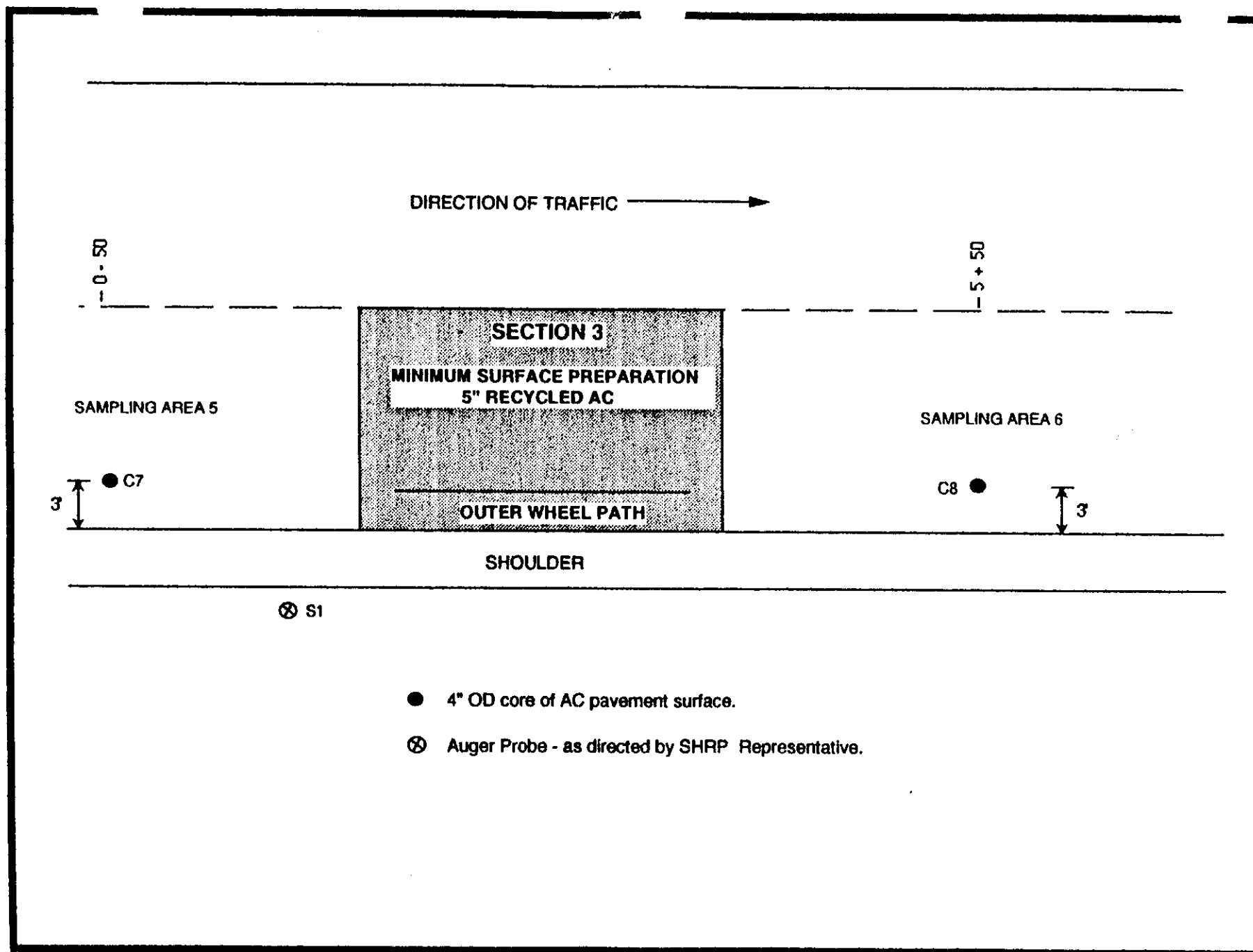


Figure A.4. Example of "Pre-Construction" Sampling Plan for Section 3.

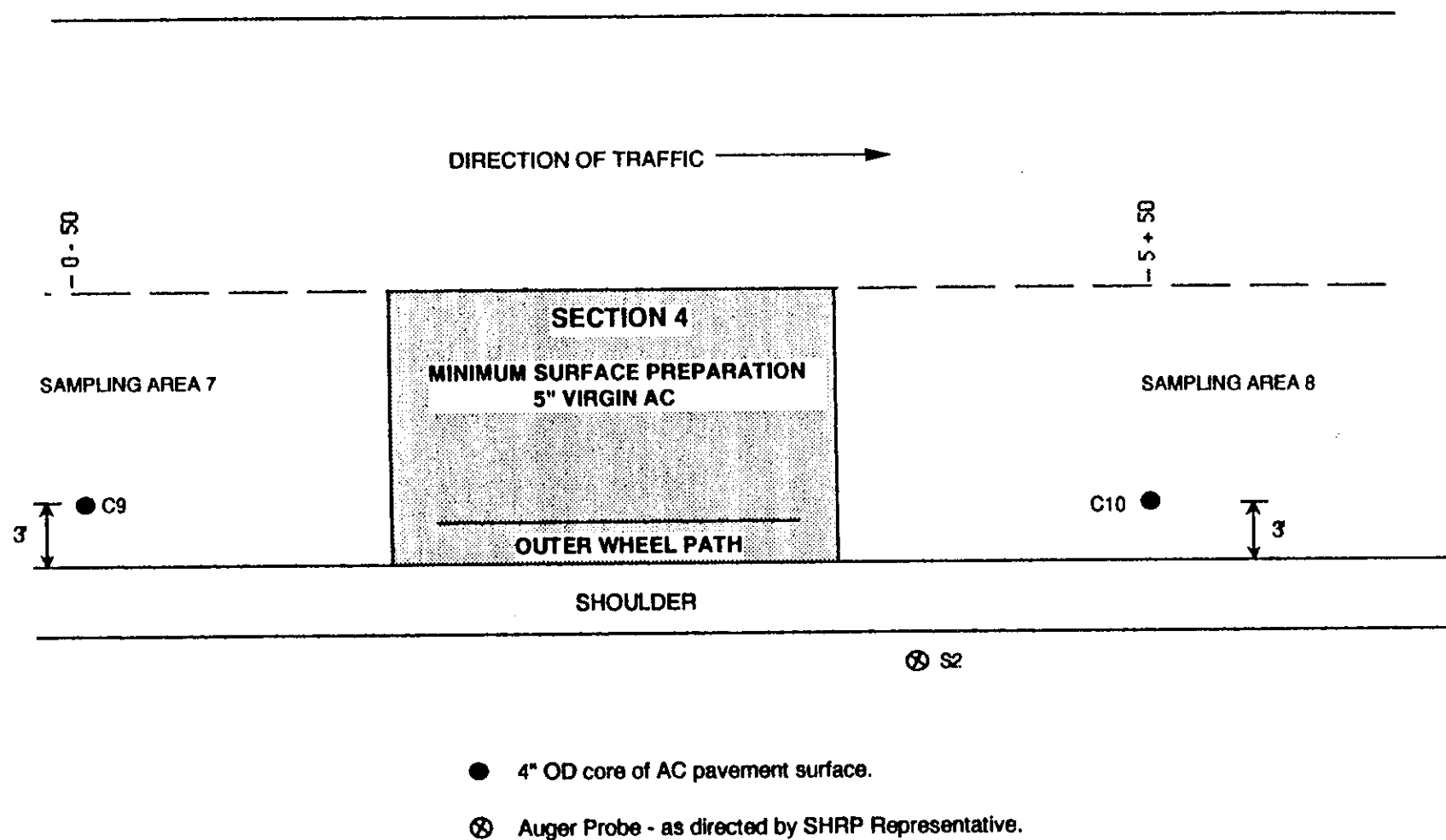


Figure A.5. Example of "Pre-Construction" Sampling Plan for Section 4.

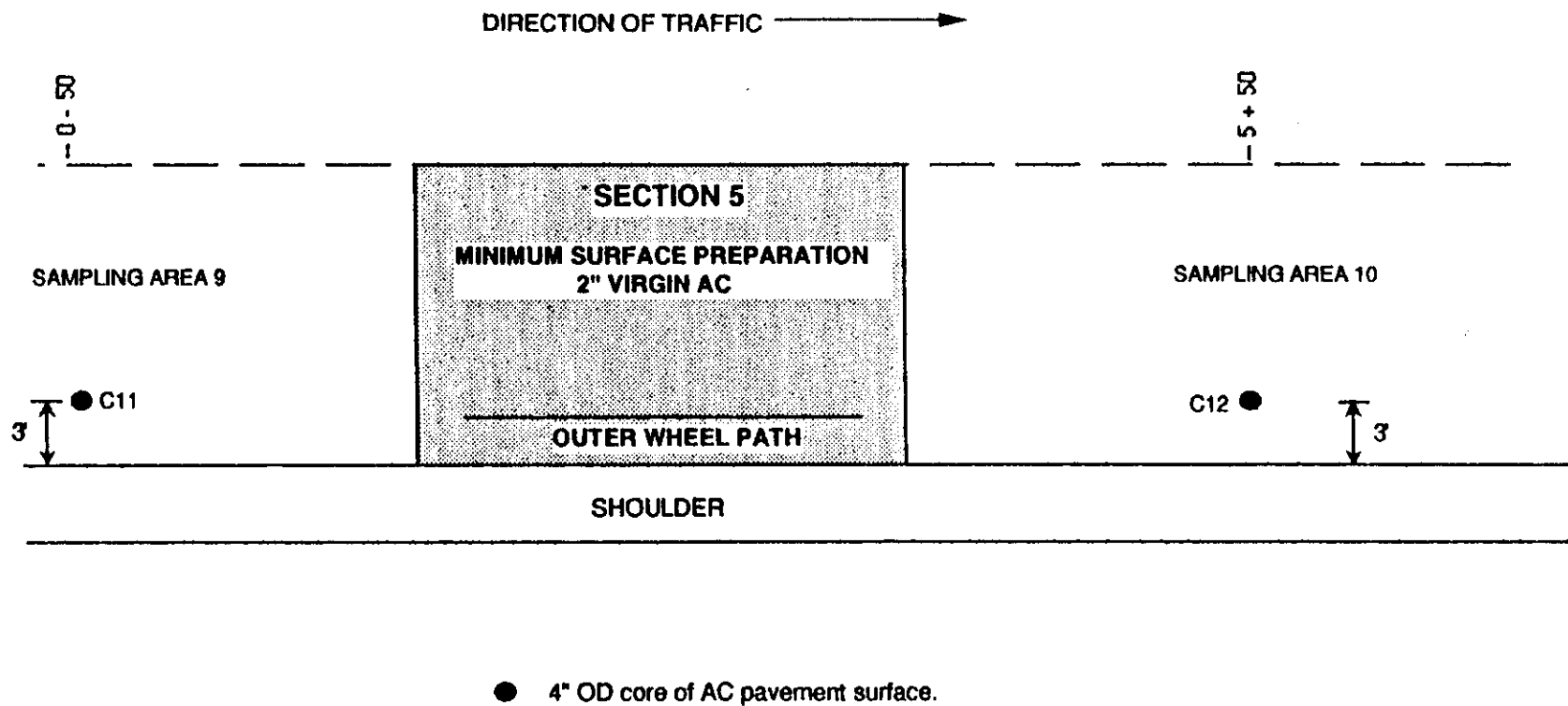
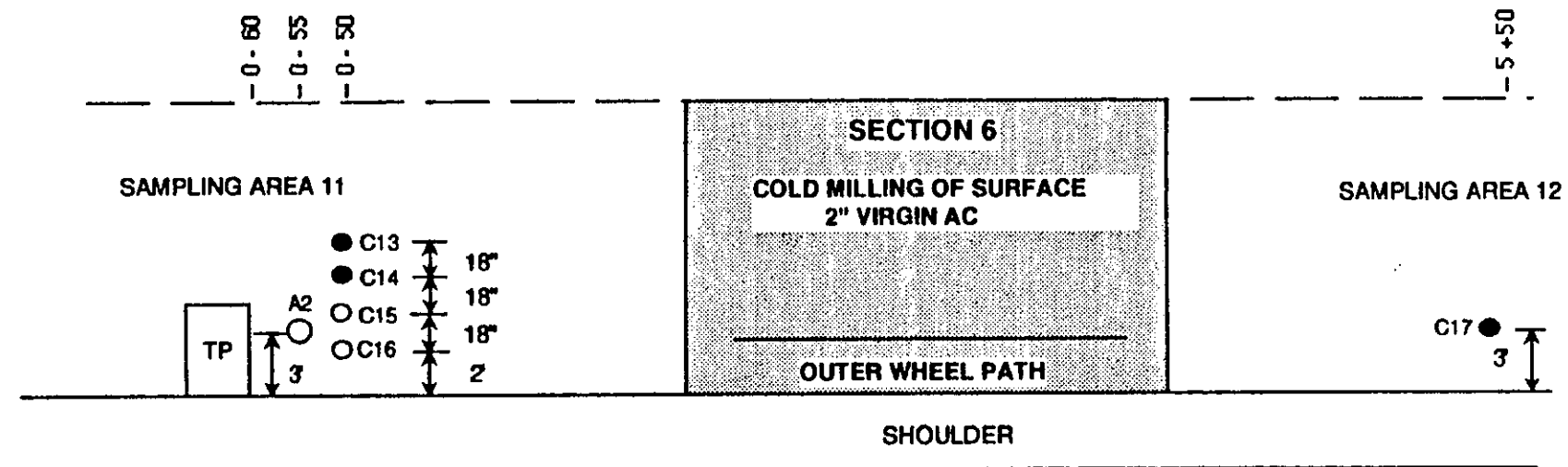


Figure A.6. Example of "Pre-Construction" Sampling Plan for Section 5.

DIRECTION OF TRAFFIC →



- 4" OD core of AC pavement surface.
- 4" OD core of AC pavement surface and treated layers.
- 6" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and /or splitspoon sampling as directed by SHRP Representative to 4' below top of subgrade.
- Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of AC pavement blocks; nuclear density and moisture samples of unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade.

Figure A.7. Example of "Pre-Construction" Sampling Plan for Section 6.

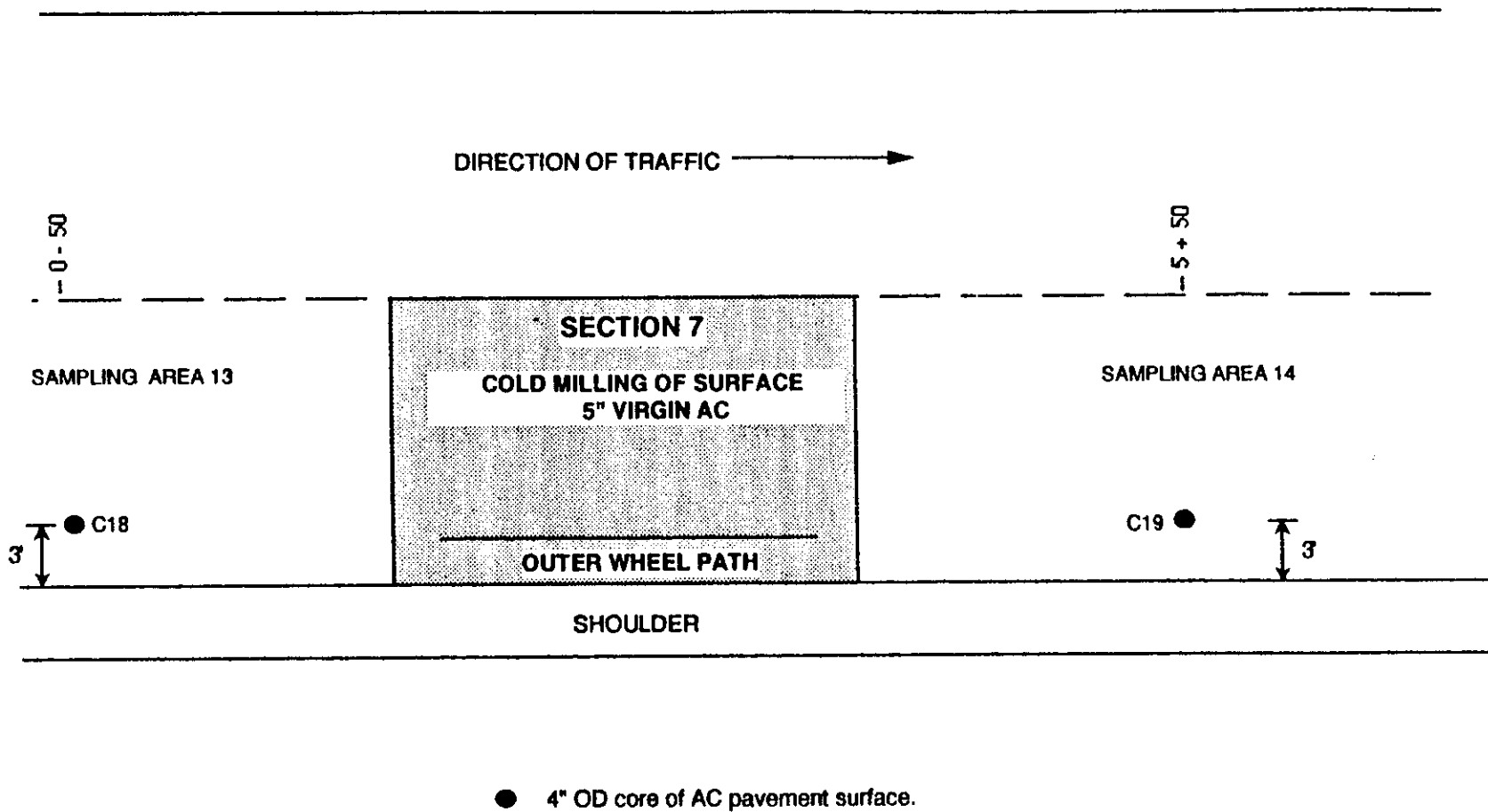
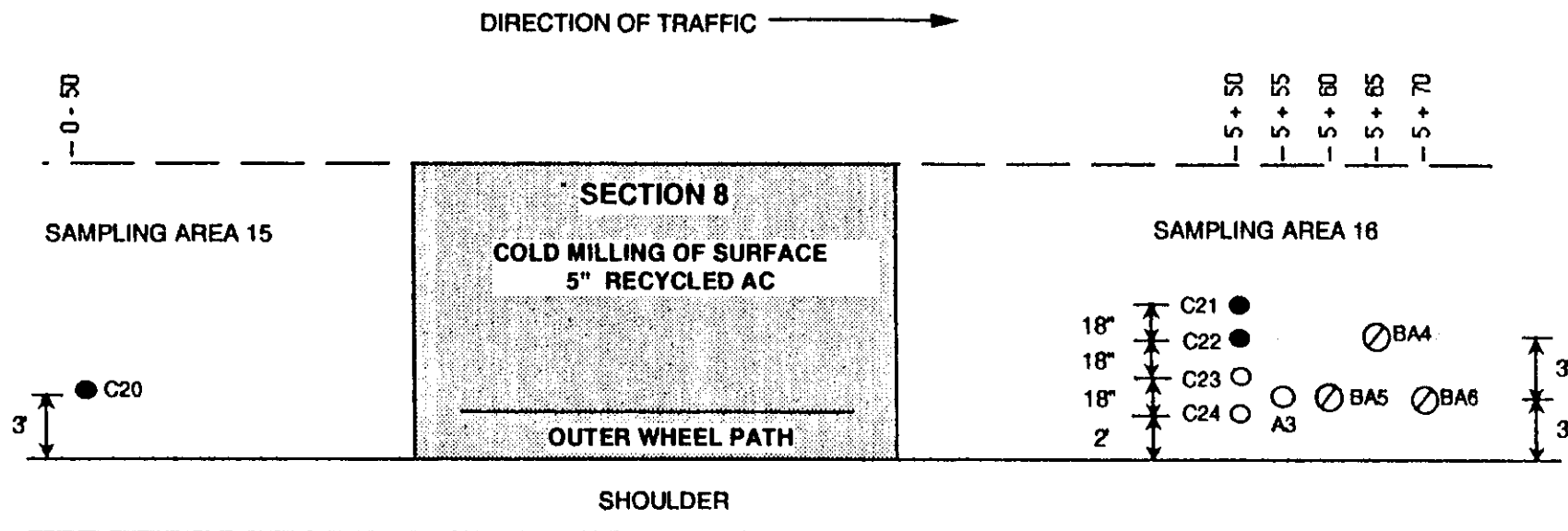


Figure A.8. Example of "Pre-Construction" Sampling Plan for Section 7.



- 4" OD core of AC pavement surface.
- 4" OD core of AC pavement surface and treated layers.
- 6" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Representative to 4' below top of subgrade.
- ⊗ 12" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval.

Figure A.9. Example of "Pre-Construction" Sampling Plan for Section 8.

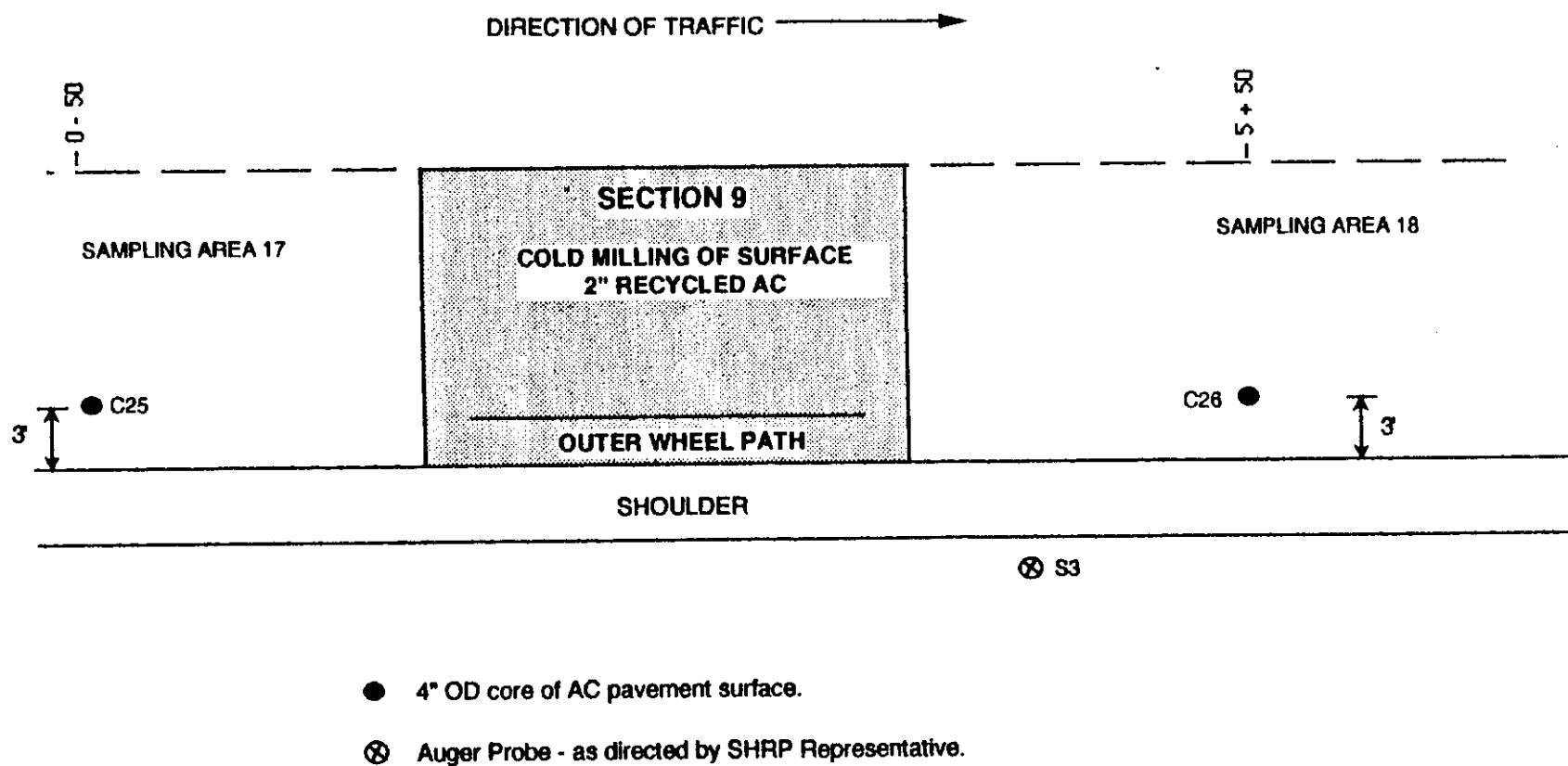


Figure A.10. Example of "Pre-Construction" Sampling Plan for Section 9.

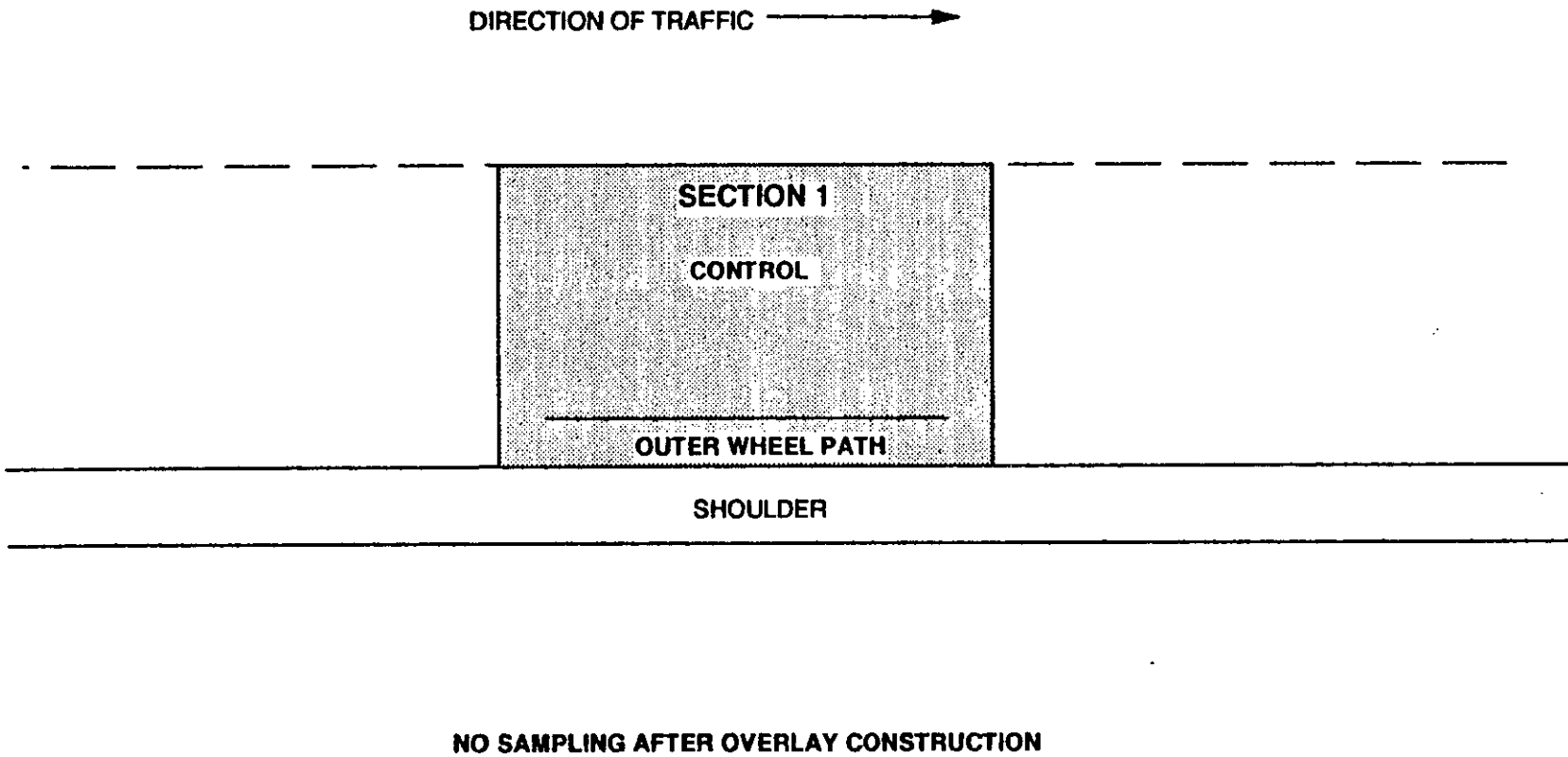


Figure B.2. Example of "Post-Construction" Sampling Plan for Section 1

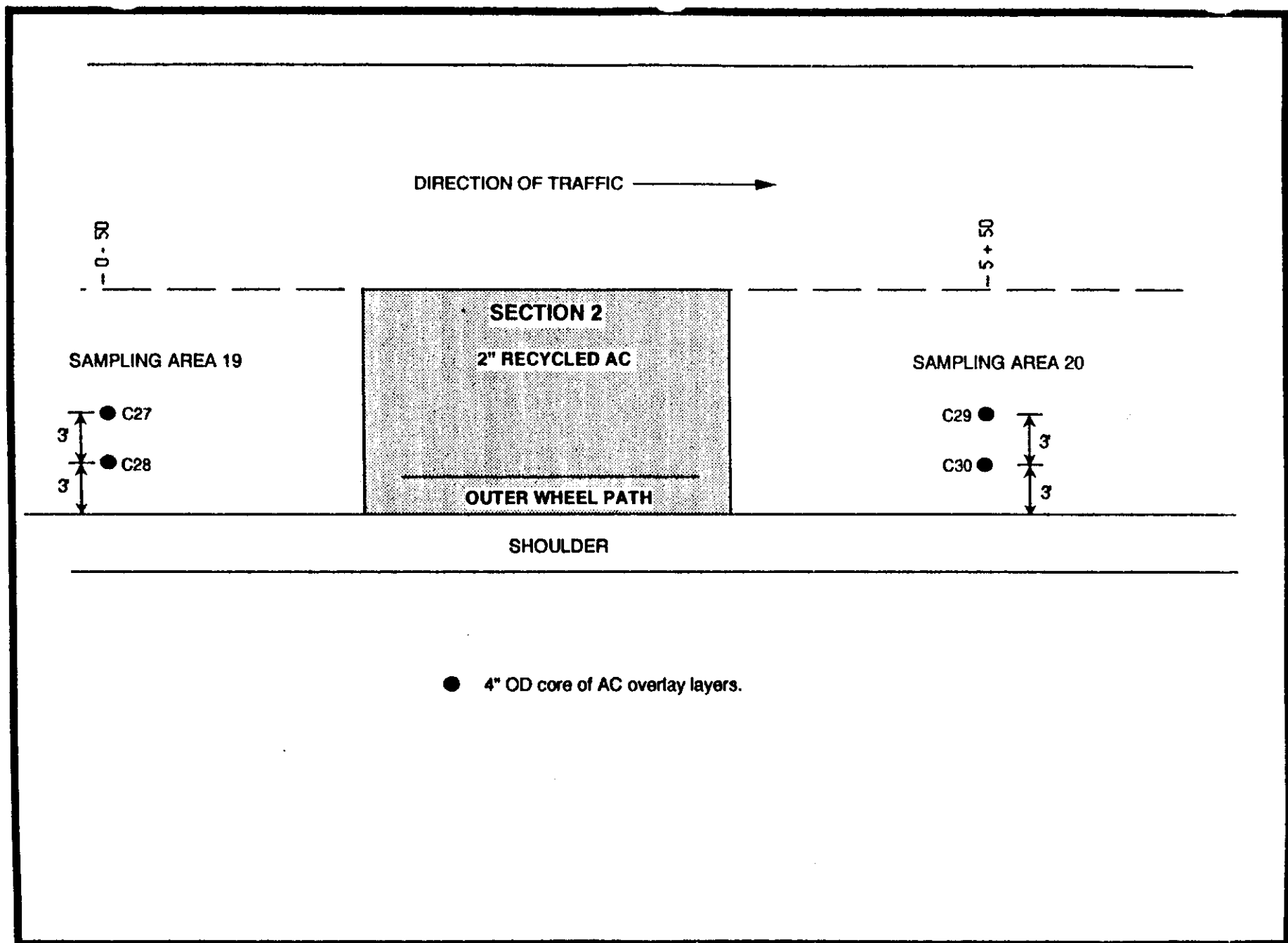


Figure B.3. Example of "Post-Construction" Sampling Plan for Section 2.

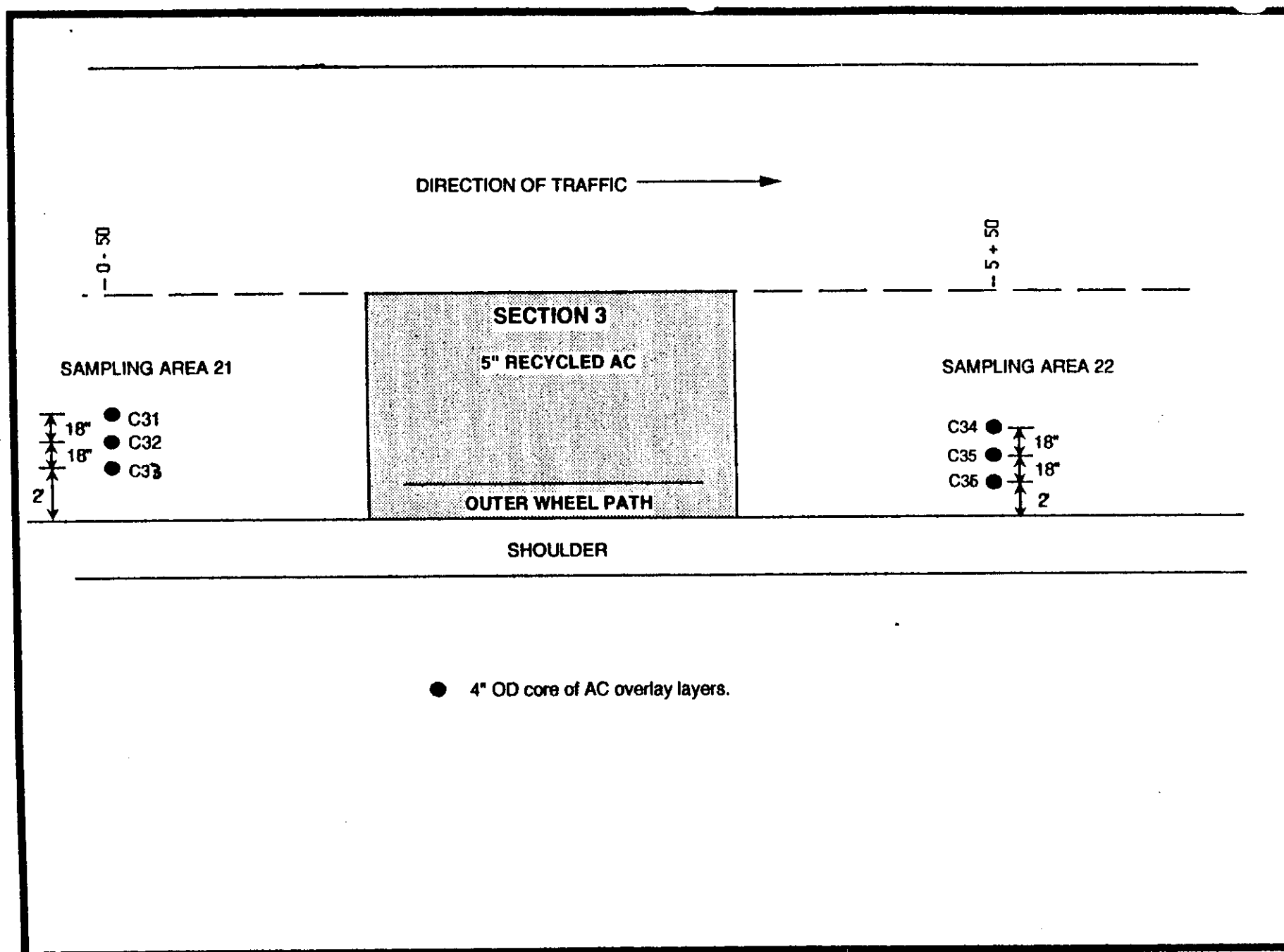


Figure B.4. Example of "Post-Construction" Sampling Plan for Section 3.

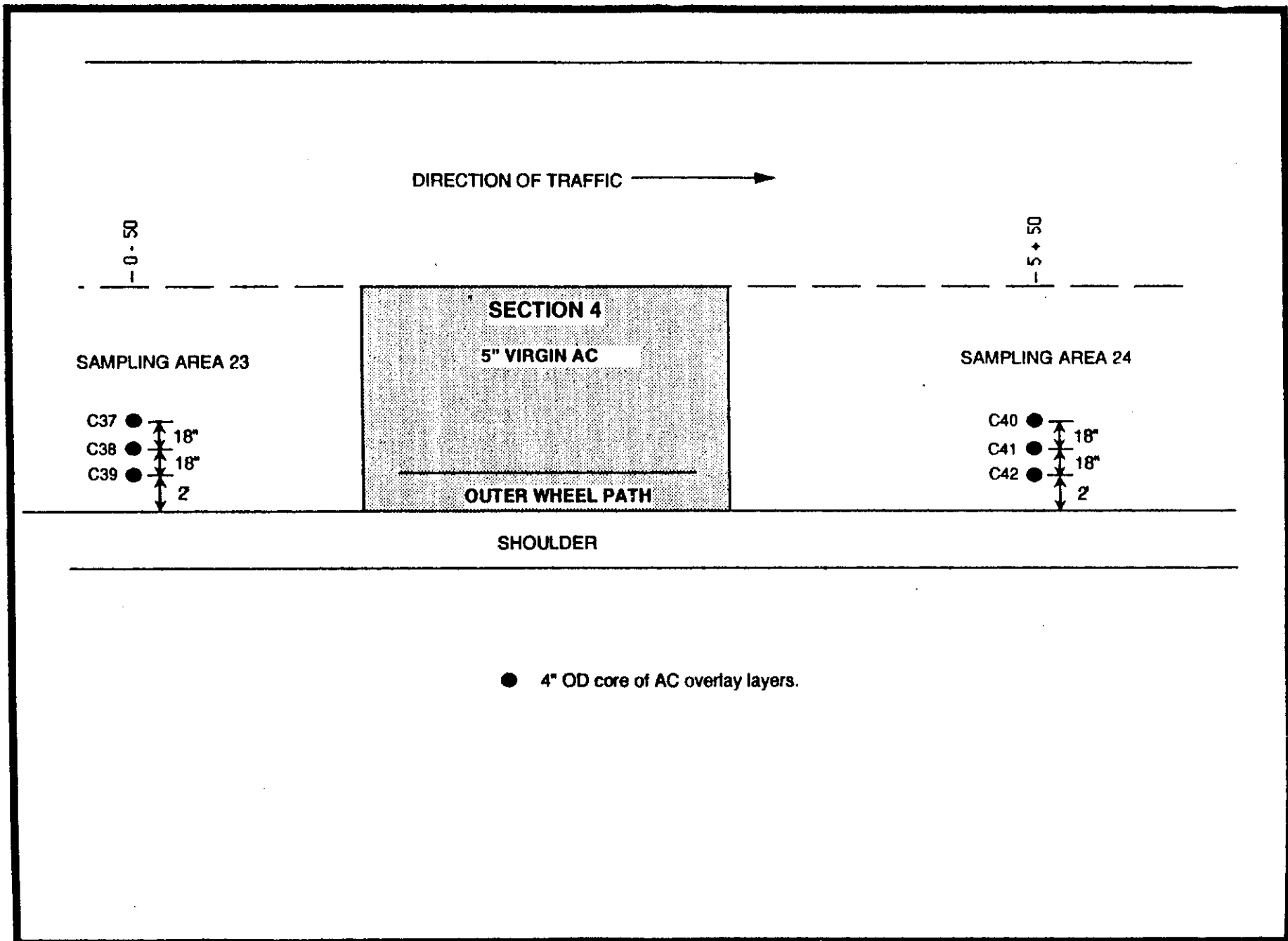


Figure B.5. Example of "Post-Construction" Sampling Plan for Section 4.

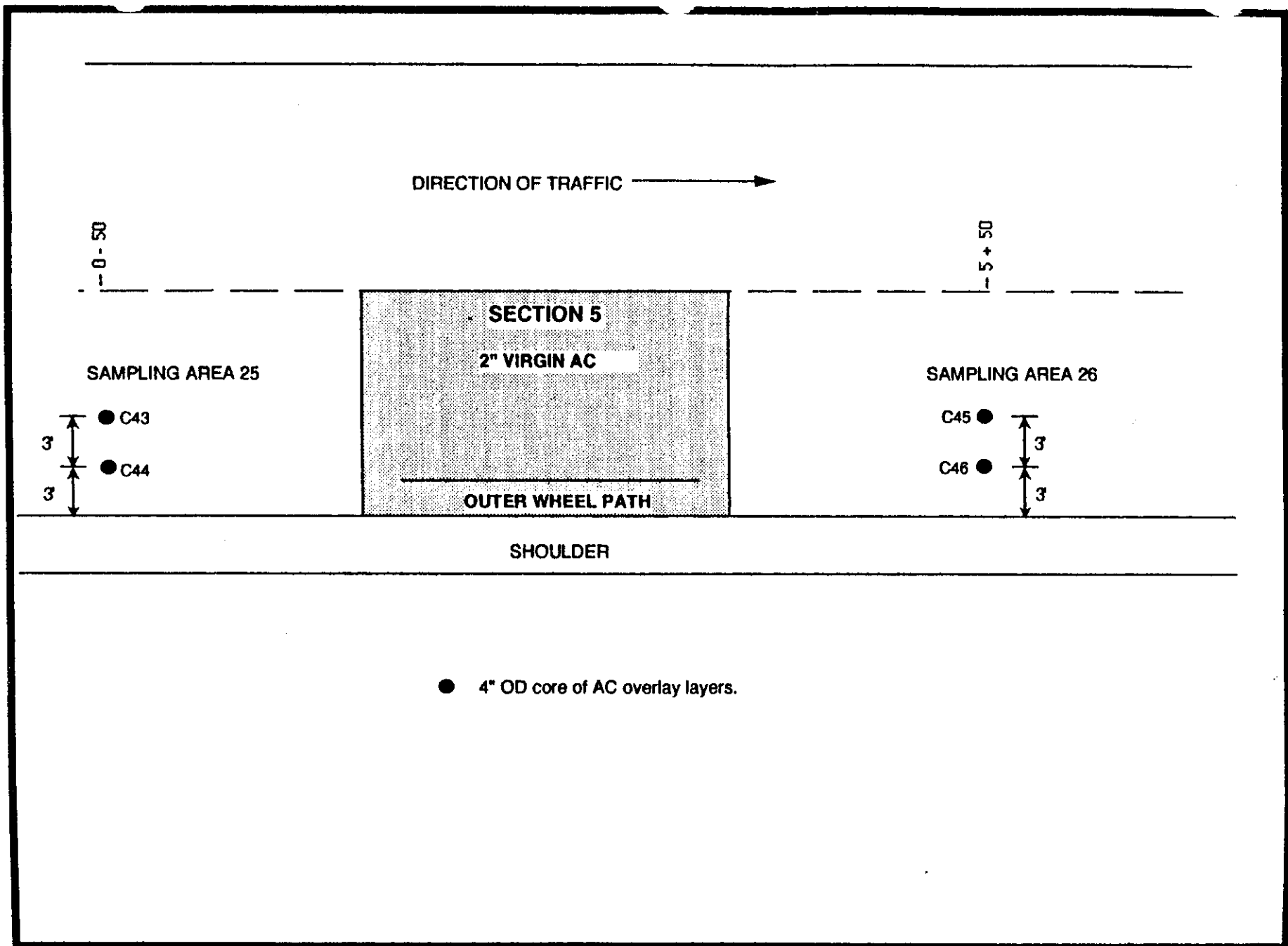


Figure B.6. Example of "Post-Construction" Sampling Plan for Section 5.

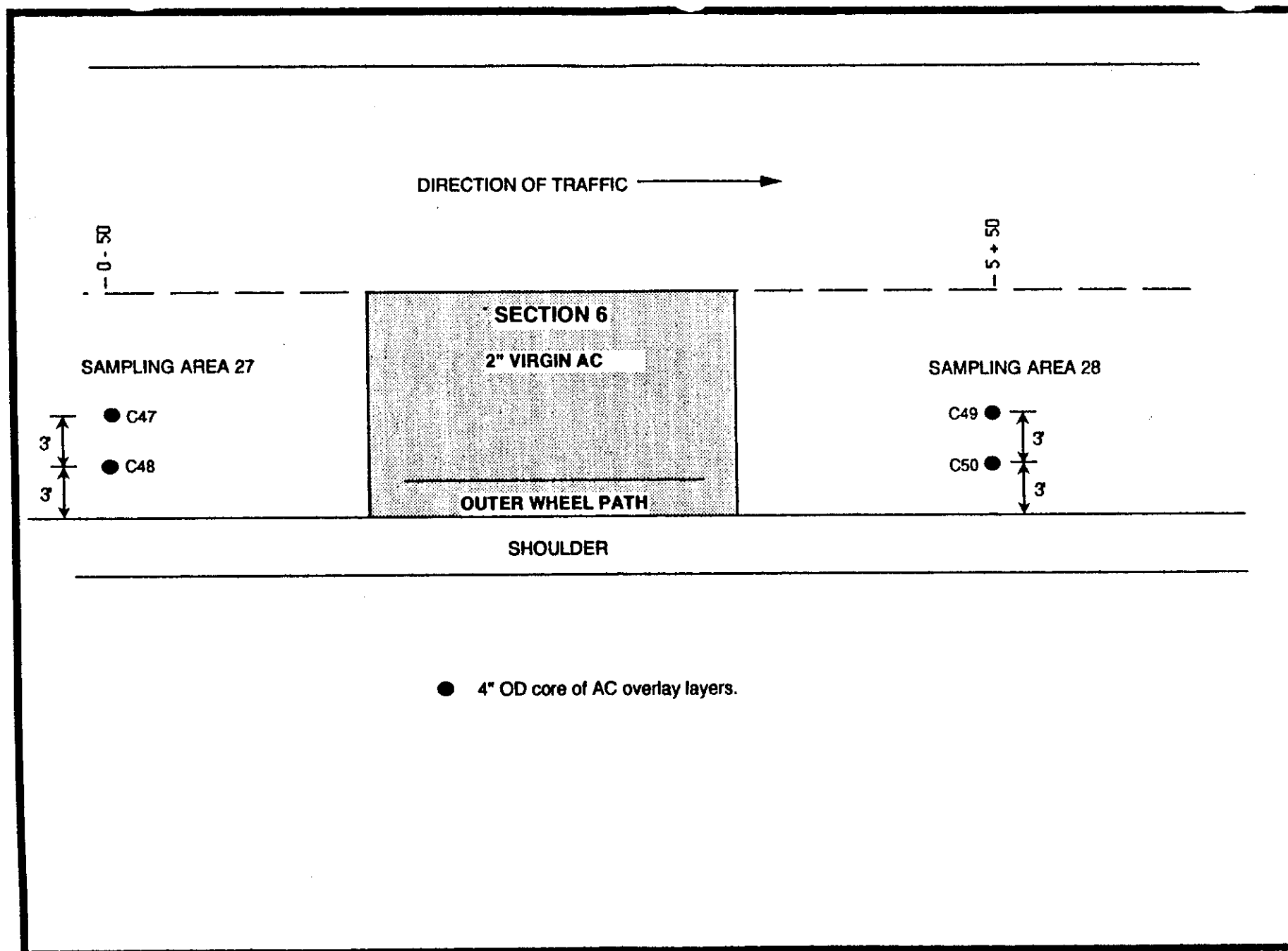


Figure B.7. Example of "Post-Construction" Sampling Plan for Section 6.

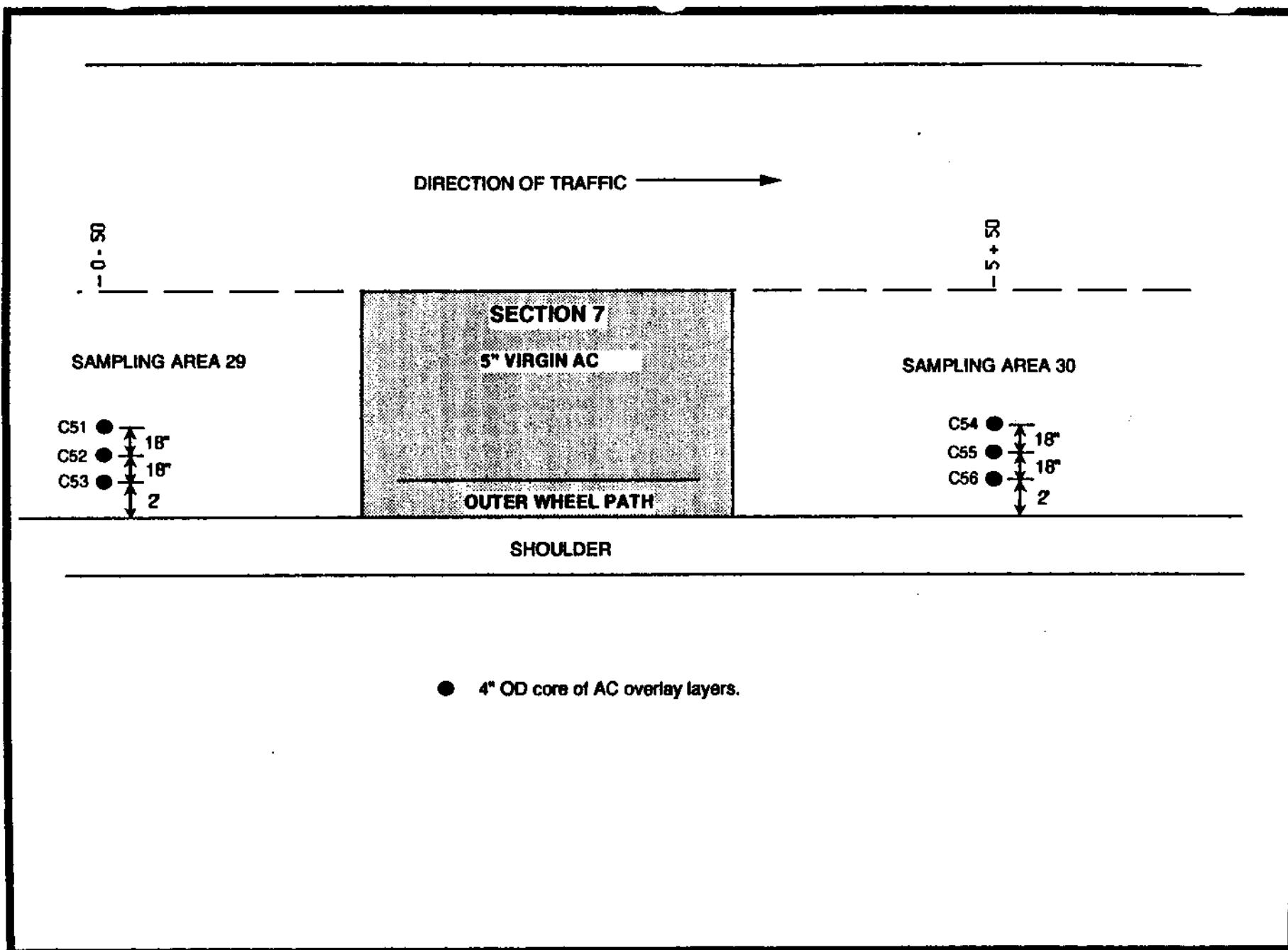


Figure B.8. Example of "Post-Construction" Sampling Plan for Section 7.

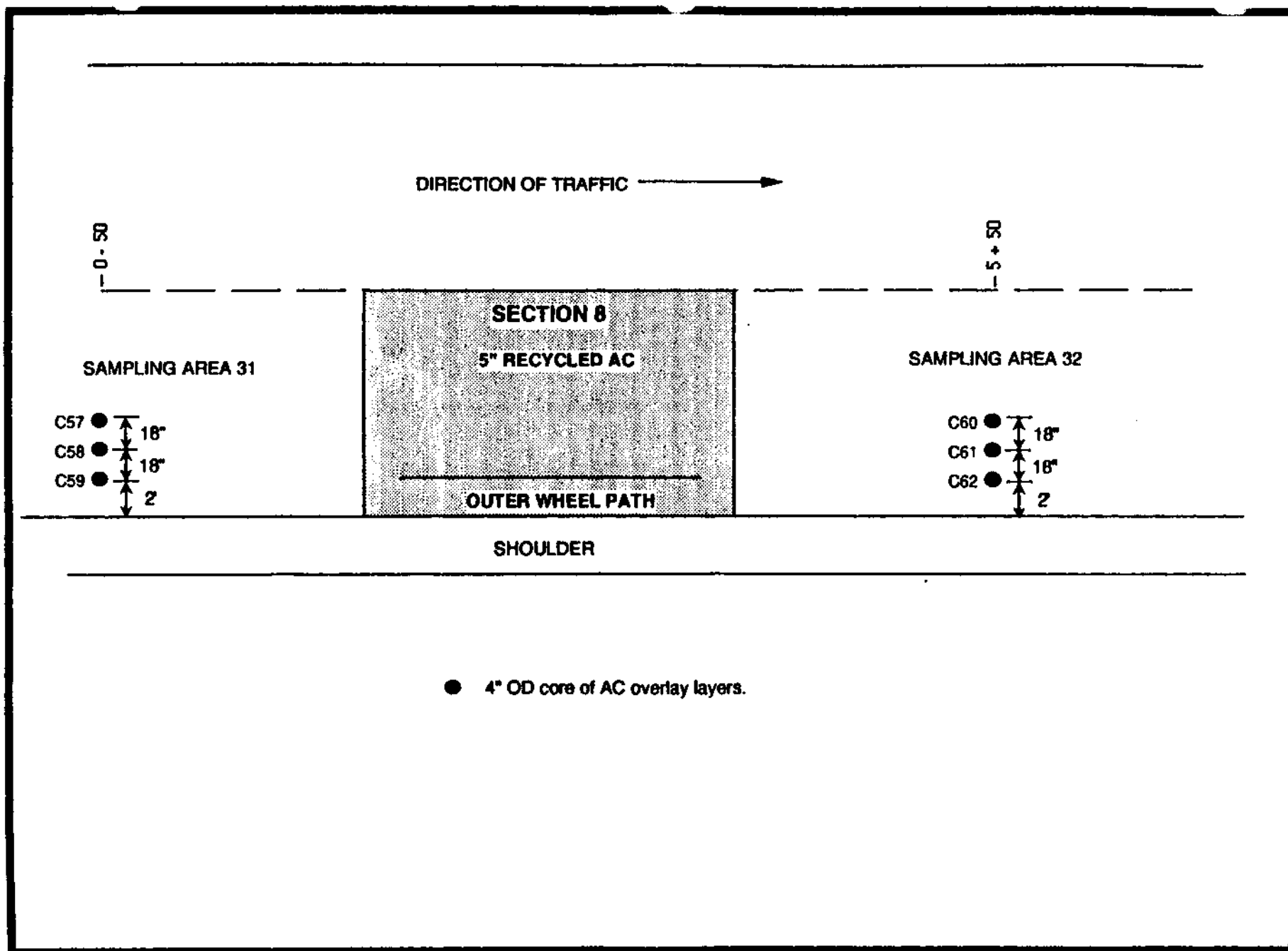


Figure B.9. Example of "Post-Construction" Sampling Plan for Section 8.

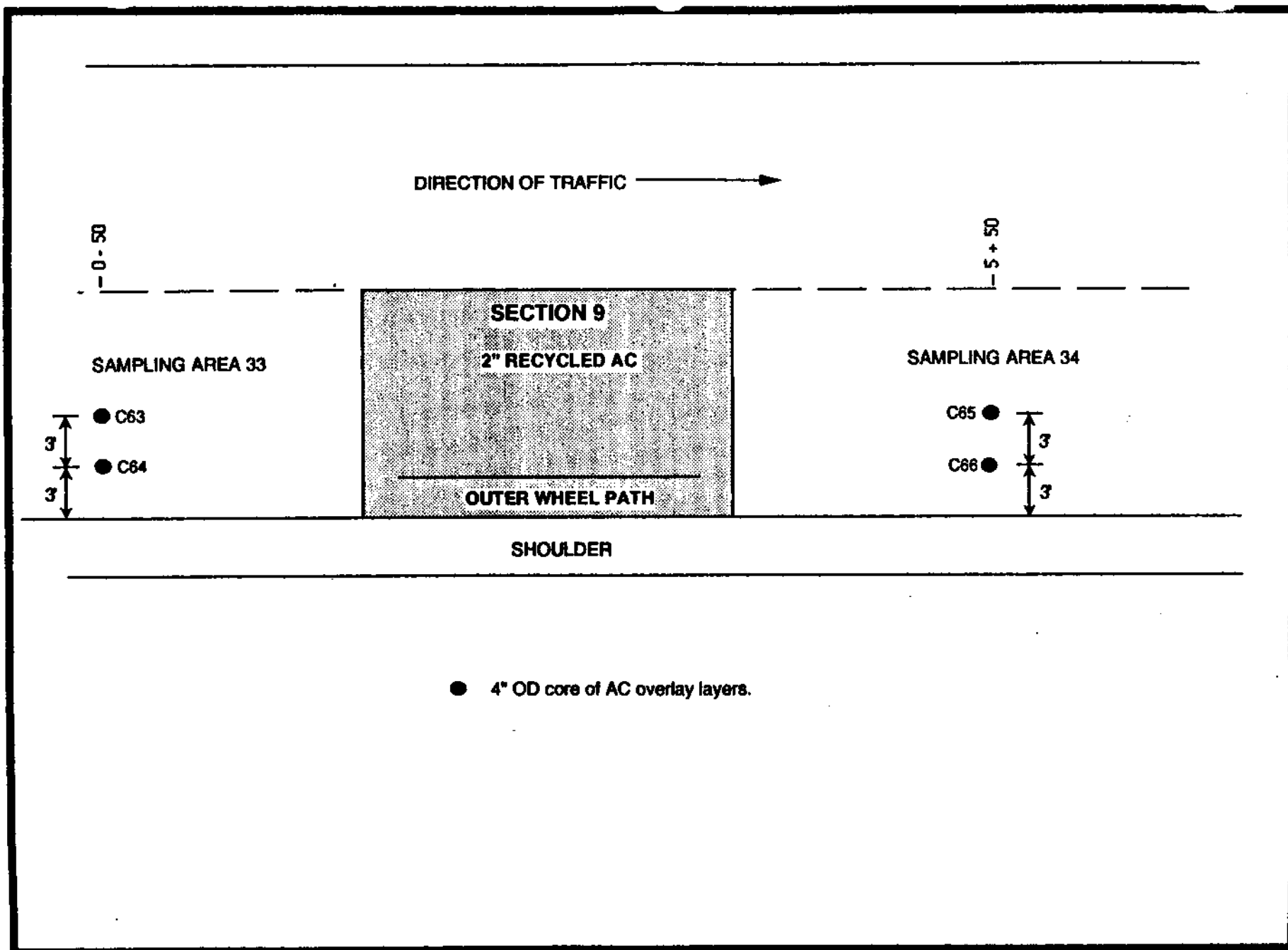


Figure B.10. Example of "Post-Construction" Sampling Plan for Section 9.

Attachment D

Layer Description and Thickness for Each Section

Table D-1. Material codes.

Material Code	Layer Code	Material Description
266	A	Subgrade-Coarse-Grain-Clayey Gravel
303	B	Base-Crushed Stone
700	C	Missouri DOT AC Binder
700	D	Missouri DOT AC Surface
700	E	Asphalt Concrete Binder PG58-28 (Recycled)
700	F	Asphalt Concrete Surface PG58-28 (Recycled)
700	G	Asphalt Concrete Binder PG64-22 (Virgin)
700	H	Asphalt Concrete Surface PG64-28 (Virgin)

Table D-2. Final layer description and thickness for each section.

Test Section	Layer Number	Layer Code	Material Code	Average Layer Thickness (mm)
290501 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	185
	4	D	700	28
290502 NB	1	A	266	N/A
	2	B	303	117
	3	C	700	178
	4	D	700	36
	5	E	700	53
290503 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	188
	4	D	700	28
	5	F	700	74
	6	E	700	48
290508 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	157
	4	D	700	0.0
	5	F	700	140
	6	E	700	53

Table D-2. Final layer description and thickness for each section (continued).

Test Section	Layer Number	Layer Code	Material Code	Average Layer Thickness (mm)
290509 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	160
	4	D	700	0.0
	5	F	700	51
	6	E	700	53
290507 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	183
	4	D	700	5
	5	G	700	117
	6	H	700	46
290506 NB	1	A	266	N/A
	2	B	303	152
	3	C	700	155
	4	D	700	0.0
	5	G	700	51
	6	H	700	53
290504 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	183
	4	D	700	28
	5	G	700	81
	6	H	700	46
290505 NB	1	A	266	N/A
	2	B	303	102
	3	C	700	196
	4	D	700	28
	5	H	700	56

Attachment E
Project Deviation Reports

LTPP SPS Project Deviation Report Site Location Guidelines Deviations	State Code	0	5	2	9
	Project Code	0	5	0	0

☐

Comments Pertain to All Test Sections on Project

☒

Comments Pertain Only to Section(s): (Specify) 290502 and 290509

Site Location Guideline Deviation Comments

290502 and 290509 are located in fill sections.

All other sections located in cut section.

LTPP SPS Project Deviation Report Data Collection and Materials Sampling and Testing Deviations	State Code	<u> 2 </u>	<u> 9 </u>
	Project Code	<u> 0 </u> <u> 5 </u>	<u> 0 </u> <u> 0 </u>



Comments Pertain to All Test Sections on Project



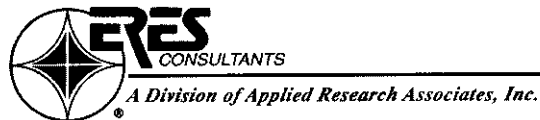
Comments Pertain Only to Section(s): (Specify) _____

Data Collection & Material Sampling and Testing Deviation Comments

No shoulder probes were performed.

Extracted aggregate tests were performed on both the virgin and recycled asphalt concrete.

Submitted by



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<http://www.eresconsultants.com>

ERES Project No. 95-075-R1